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MINERALOGY.¹

Contributions to Swedish Mineralogy, Part I:—In this paper Sjögren² has given in English a very interesting series of crystallographical studies. The well known but rare axinite from Nordmarken is reexamined. In addition to the tabular crystals described by Hisinger and v. Rath's prismatic type, a third type of smaller crystals is identified having neither the tabular nor the prismatic habits and highly modified. Hedyphane which is closely related chemically to the members of the apatite group, particularly mimetite, has been supposed to possess monoclinic symmetry on the basis of Des Cloiseaux's determination in 1881. Sjögren has examined crystals from the Harstigen mine in Wermland and finds that both crystallographically and optically hedyphane is hexagonal. The crystals examined exhibited the forms ∞P , ∞P , P , $\frac{1}{2}P$, $2P$, $P2$, $2P2$, and clearly belong to the apatite group. Another member of the apatite group is discovered in Sjögren's new mineral svabite, which occurs in schefferite at the Harstigen mine. Svabite is a hydrous calcium arsenate of the composition indicated by the formula $HO Ca_5 As_3 O_{12}$ in which the hydroxyl appears to be part replaced by chlorine and fluorine. The mineral is crystallographically like apatite and exhibits the forms ∞P , P , $P2$, ∞P . The same mineral was found at Jacobsberg, enclosed in hausmannite. A very exhaustive study is made of the minerals of the humite group, all of which are found at Nordmarken. No less than 29 forms were observed on chondrodite from this locality, and these include the six new forms, $+\frac{1}{2}P$, $-\frac{1}{5}P$, $+\frac{1}{5}P$, $-\frac{3}{7}\bar{P}\frac{3}{2}$, $+\bar{P}2$, $-\frac{3}{11}\bar{P}\frac{3}{2}$. The humite of the locality showed 20 and the clinohumite 26 forms, all of which have been observed on Vesuvian crystals. A probable fourth member of the humite group which occurs at Nordmarken, is announced in this paper. Three new analyses of longbanite are contributed, on the basis of which the formula of the mineral is given as $mSb_2O_3 \cdot nFe_2O_3 \cdot pR^{IV}R^{II}O_3$ in which $R^{IV} = Mn$ and Si , and $R^{II} = Mn, Ca$, and Mg . The symmetry of the mineral is shown to be rhombohedral, this and the chemical constitution indicating its isomorphous relation with hematite and ilmenite. Adelite is the name given to a new basic arseniate from Nordmarken, Jacobsberg and Longban, having the for-

¹Edited by Dr. Wm. H. Hobbs, University of Wisconsin, Madison, Wis.²Bull. of the Geol. Inst. of Upsala, I; No. 1, (1892), pp. 1-64, pls. I-IV.

mula 2CaO , 2MgO , H_2O , As_2O_5 . The symmetry of the mineral is monoclinic and its relationships, both chemical and crystallographical, are with triploidite, wagnerite and sarkinite.

Optical Methods :—Friedel³ has devised a new method for determining the double refraction in thin sections of minerals on the stage of the ordinary petrographical microscope. The method makes use of the quarter undulation mica plate. The nicols are crossed and the slide is raised a short distance above the stage on thin blocks, so as to allow of the introduction of the mica plate between the slide and the stage. The stage is now revolved until the directions of extinction make 45° with the principal sections of the nicols. The mica plate is introduced below the slide and carefully turned without moving the stage until that portion lying outside the mineral plate is extinguished. By now revolving the polarizer, the mineral can be extinguished or given the same illumination as the mica plate. The observations are made in monochromatic light. If the positive direction of the mineral plate passes through the upper right quadrant of the field and the positive direction of the mica plate coincides with the vertical cross hair, the polarizer should be revolved to the right, the angle φ required to produce extinction, and the angle φ_1 required to produce equal illumination of mineral plate and mica plate, yielding ψ the difference in phase produced in the mineral section. The formulas are $\psi = \varphi_1$ and $\psi = 2\varphi_1$. The greater part of the paper is devoted to methods of evaluating errors in the process.

Harker⁴ has determined trigonometrically the values of the extinction angle in prismatic cleavage flakes of augite and hornblende, as dependent on the optical angle and the extinction angle in the plane of symmetry. His tables of values will be convenient for reference, but as he points out, the variation in the values with $2V$ is not great enough to determine the optical angle from measurements of the prismatic and clinopinacoidal extinction angles.

Isotypism :—Rinne⁵ compares crystals of the metals with crystals of their oxides, sulphides, hydroxides and haloid compounds. He points out that in this comparison we find strikingly close relationships between bodies markedly different chemically, and these relationships do not consist simply in identity of crystal symmetry, but in

³Bull. Soc. Franç. Minér., XVI; 19 (1893).

⁴Min. Mag., X (No. 47), p. 239.

⁵Neues Jahrb. f. Min., etc., 1894, (I) pp. 1-55.

close approximation to a type as regards crystal shape (Krystallgestalt) and interfacial angles. Even when the symmetry of two substances is not identical, he makes comparison of the crystal shape as, e. g., between a cube and a rhombohedron with polar edge approaching 90° . The author distinguishes seven types as follows: I regular type (isometric), II magnesium type (hexagonal and pseudo-hexagonal—orthorhombic), III arsenic type (rhombohedral), IV quartz type (hexagonal tetartohedral), V \widehat{a} tin type (tetragonal), VI rutile type (tetragonal and pseudo-tetragonal—orthorhombic), VII β tin type (orthorhombic and pseudo-orthorhombic—monoclinic). Every group but the fourth contains metals and this type Rinne considers as derivable from the third or arsenic type. Many oxides, etc., have their crystal forms to some extent indicated in the forms of their contained metals. The term isotypism is proposed to describe these crystallographical relations between members of different divisions of the chemical mineral system. The author further states, "It must now be accepted as a fact that such substances" (elements, oxides, sulphides, haloid salts, and even silicates, which have been grouped together under his various types) "possess equivalent or very similar crystal forms, and it follows that the chemical differentiation into elements, oxides, salts, etc., finds no crystallographical expression, and therefore no independent, certain conclusion as to the chemical group to which a compound belongs can be drawn from its crystal form."

Lamellar Structure in Quartz Crystals.—In an "additional note on the lamellar structure of quartz crystals and the methods by which it is developed," Professor Judd⁶ describes and figures a remarkably beautiful instance of lamellar structure in quartz, in which he sees a close analogy with the "rippled fracture" which he finds can be produced in quartz crystals by breaking them in a powerful vice along a plane perpendicular to the optic axis. The appearance of such fractures is very much like that of "engine-turned surfaces." This appearance is caused by ridges following the planes R and -R, which are often curved and die out in the manner of plagioclase lamellæ. From a study of the lamellæ in an equatorial section of quartz supposed to be one of those investigated by Brewster, Professor Judd concludes that quartz is dimorphous. What he calls "stable quartz" shows no tendency to assume a lamellar structure, whereas "unstable quartz" constantly exhibits such a tendency. The latter variety is usually amethystine. The lamellæ consist of alternating bands of

⁶Min. Mag., X, p. 123.

right and left handed quartz. When they are bent or disturbed they furnish biaxial interference figures. Many crystals are composed of both stable and unstable quartz, the relative positions of which show some relation to the symmetry of the crystal. Such crystals, or crystals composed entirely of unstable quartz, have the lamellæ induced by great mechanical stresses. The fact that the structure is only faintly induced and that very near the fracture in artificially crushed crystals, is explained by the short time during which the stress is applied, permanent structure being produced only after a long application of the stress.